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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/530,916

04/08/2005

Lun Kai Cheng

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EXAMINER

LYONS, MICHAEL A

ART UNIT

PAPER NUMBER

2877

MAIL DATE

DELIVERY MODE

07/12/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/530,916

Applicant(s)

CHENG, LUN KAI

Examiner

Michael A. Lyons

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2877

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 2 is/are allowed.
- 6) ☒ Claim(s) 1 and 3-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 April 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application
- ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuest ("Integrated optical Michelson-interferometer with quadrature phase demodulation in glass for displacement measuring").

Regarding claim 1, Fuest (Figs. 6, 8, and 9) discloses an apparatus for measuring an optical path length difference, the apparatus comprising optical elements in the form of lenses, a beam splitter, and a series of various reflectors that guide light from light source LD through a first path and a second path, the paths generated at a beamsplitter, an at least three-way coupler, such as shown in Figure 6, that combines light from the first and second paths with each other in at least three combinations with at least three mutually different added relative phase displacements, a detector (D1-D3 in Fig. 9) that measures interference intensities of the at least three combinations, and a calculation unit (not shown, but disclosed on page 157, column 2) that determines a phase difference between light from the first path and the second path (pages 156-157).

Fuest, however, fails to explicitly disclose the calculation unit eliminating an effect of a contrast between light from the first path and the second path.

The instant specification defines contrast as the difference between the amplitudes of the light from the first and second light paths, which essentially defines an intensity difference. Having light of a strong intensity interfere with light of a weaker intensity will generate an interference pattern dominated by the more intense light, leading to an inaccurate signal.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to eliminate contrast between light in the first and second path, the motivation being to provide a cleaner, more accurate interference signal and thereby a more accurate measurement with equal contributions to the measurement from both the first and second light paths. It is noted, however, that nothing in Fuest discloses the amplitude of the light in the system of Figure 9 changing as light passes through the system, leading to contrast being inherently eliminated in the device of Fuest through its normal operation.

As for claim 3, Fig. 6 shows that the light exiting the three-way coupler receives a different phase shift depending on the path the light exits, with the phase shift being 0, 120, or 240 degrees.

As for claim 4, the coupler disclosed in Fig. 6 comprises three mutually coupled waveguides (see Page 156, column 1).

As for claim 5, Fuest discloses the claimed invention as set forth regarding claim 1, and also discloses a path length controller as indicated by the arrow and Δx notation in Figure 9. However, Fuest fails to disclose the calculation unit coupled to the path length controller as a feedback unit to control the calculated phase difference in feedback to a desired phase difference. Official Notice is taken, though, as to the well known use of feedback loops in interferometry to control a device in response to a measured quantity, and it would have been obvious to one

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having ordinary skill in the art at the time the invention was made to use a feedback loop in the device of Fuest to control the phase difference, the motivation being that controlling the phase difference to be set at a desired amount will lead to more optimal operation of the device, and thereby generate better results.

Regarding claim 6, Fuest (Figs. 6 and 8-9) discloses a method for measuring an optical path length difference, the method comprising guiding light from a light source LD through a first path and a second path defined by a group of lenses and various reflectors, combining light from the first and second path into at least three combinations with at least three mutually different added relative phase displacements with a three-way coupler as explicitly defined in Figure 6, measuring interference intensities of the at least three combinations with a series of detectors D1-D3, and calculating, with an inherent calculating unit, a phase difference between the light from the first and second path (pages 156-157).

Fuest, however, fails to disclose the calculating unit eliminating an effect of a contrast between the light from the first and second path.

The instant specification defines contrast as the difference between the amplitudes of the light from the first and second light paths, which essentially defines an intensity difference. Having light of a strong intensity interfere with light of a weaker intensity will generate an interference pattern dominated by the more intense light, leading to an inaccurate signal.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to eliminate contrast between light in the first and second path, the motivation being to provide a cleaner, more accurate interference signal and thereby a more accurate measurement with equal contributions to the measurement from both the first and

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second light paths. It is noted, however, that nothing in Fuest discloses the amplitude of the light in the system of Figure 9 changing as light passes through the system, leading to contrast being inherently eliminated in the device of Fuest through its normal operation.

Regarding claim 7, Fuest (Figs. 6 and 8-9) discloses a method for comprising sampling interference intensities of at least three combinations of light from a three-way coupler of light from a first and second light path, wherein the light in the three combinations is combined with at least three mutually different added relative phase displacements (see coupler in Figure 6), and calculating a phase difference between the light from the first and second light path (pages 156-157).

Fuest, however, fails to disclose the calculation eliminating an effect of a contrast between the light from the first and second path, with the method being on a computer program product.

The instant specification defines contrast as the difference between the amplitudes of the light from the first and second light paths, which essentially defines an intensity difference. Having light of a strong intensity interfere with light of a weaker intensity will generate an interference pattern dominated by the more intense light, leading to an inaccurate signal.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to eliminate contrast between light in the first and second path, the motivation being to provide a cleaner, more accurate interference signal and thereby a more accurate measurement with equal contributions to the measurement from both the first and second light paths. It is noted, however, that nothing in Fuest discloses the amplitude of the light

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in the system of Figure 9 changing as light passes through the system, leading to contrast being inherently eliminated in the device of Fuest through its normal operation.

As for the computer program product, it would have been obvious to one having ordinary skill in the art at the time the invention was made to place the method of Fuest on a computer program product for execution by a computer, the motivation being that executing the method via computer control rather than by a human operator will lead to faster measurements repeated with higher accuracy due to the structured, non-random nature of the computer program.

Allowable Subject Matter

Claim 2 is allowed in view of the prior art.

The following is a statement of reasons for the indication of allowable subject matter:

As to claim 2, the prior art of record, taken either alone or in combination, fails to disclose or render obvious an apparatus for measuring an optical path length difference, the apparatus comprising a limitation in addition to the rest of the limitations of the claim wherein the intensities of the at least three combinations of light are represented by the disclosed formulae, in combination with the rest of the limitations of the above claim.

Response to Arguments

Applicant's arguments filed April 5, 2007 have been fully considered but they are not persuasive. It is first noted, however, that the 35 USC 112 and 35 USC 101 rejections have been properly overcome and the rejections thereby withdrawn.

Regarding the 35 USC 103 rejection, the applicant argues, "Fuest merely confirms what is conventional in the art, namely, that it is desirable to have a predetermined or zero contrast when determining path length difference between two optical paths". The examiner agrees with

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this statement; naturally, contrast needs to be controlled or eliminated to prevent the intensity of one beam of light from overpowering another in an interference pattern. However, instant claim 1 (and by extension, instant claim 6) claims, "a calculation unit arranged to determine, from the intensities, a phase difference between the light from the first and second paths while eliminating an effect of a contrast between the first and second paths". The claim sets forth the elimination of the contrast in the system, yet remains silent on how the elimination occurs. As such, the admittedly well known desire to have zero contrast when determining path length difference is functionally the same as "eliminating an effect of a contrast between the light from the first and second paths" as claimed, since having a zero contrast inherently eliminates the effect of any contrast between interfering light beams. Additionally, contrary to applicant's arguments, Fuest discloses a three-way coupler to combine light from first and second light paths with each other in different relative phase displacements to provide phase difference between the light in each beam as per Figure 6 of Fuest.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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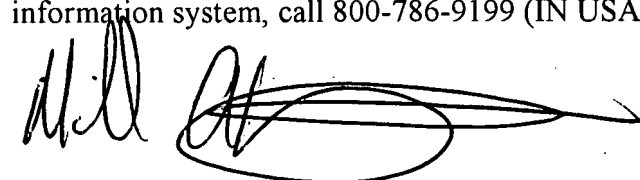
however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael A. Lyons whose telephone number is 571-272-2420.

The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley can be reached on 571-272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

A handwritten signature in black ink, appearing to be 'M. Lyons', followed by a large, stylized circular flourish or scribble.

Michael A. Lyons
Patent Examiner
July 2, 2007